

FST-51200.60.19.07: Severe Accident Phenomena Experiments and Collaborations year 1/3

- Project Lead: J. Buell
- Technical Leads: J. Spencer and L. Lebel

Objectives:

- Develop expertise in corium spreading, debris coolability, molten corium concrete interaction (MCCI)
- Improve knowledge of corium convection and spatial distribution of heat flux during in-vessel retention (IVR)
- Evaluation of radionuclide removal due to scrubbing in boiling conditions representative of a re-flooded corium pool

Stakeholder (Primary)

- CNSC

OECD Reduction of Severe Accident Uncertainties (ROSAU) Project

- 5 year Nuclear Energy Agency (NEA) project led by Argonne National Laboratory
- Focus is on corium melt spreading, debris coolability, and MCCI

Status and Future Work

- CNL will join the project and perform duties associated with membership such as attending meetings
- Kickoff meeting planned for later this fiscal year
- Two categories of experiments planned:
- Large-scale underwater melt spreading experiments
 - Dry spreading
 - Wet spreading (different water levels)
 - Low and high corium flow rates
- Debris coolability and MCCI experiments. Two of the proposed tests are of particular interest:
 - water ingress cooling of in-vessel core melt
 - water ingress cooling with concrete basemat

BARC – CNL Collaboration on Severe Accidents

- Previously CNL and Bhabha Atomic Energy Research Institute (BARC) collaborated on IVR severe accident research
 - Work undertaken under the R&D Cooperation program of the Joint Committee overseeing the Canada-India Nuclear Cooperation Agreement

- Near wall void fraction in the end shield
- Natural convection in shield tank and corium pool
- Flow of corium through tubes
- This task is the continuation of this collaboration and will include the publication of experimental and simulation results from the previous collaboration and a joint report
 - Work will be carried out under the Nuclear S&T Agreement between Canada and India

Status and Future Work

- Discussions with BARC ongoing
- Leverage experimental and simulation results from previous CNL-BARC collaboration

Flooded Corium Pool Scrubbing

- The release of fission products from a terminal bed of molten corium is an important contributor to releases in the long term
- If the corium is submerged under a water layer, fission products may be scrubbed out
- Efficiency of this process is uncertain
- Results will help guide severe accident management

Status and Future Work

- Planned for this fiscal year:
 - Conceptualization of experiments (determine how the experiments will be conducted and what phenomena is important)
 - Develop experimental test plan
 - Prepare design drawings and procure apparatus
- Construction of apparatus and actual experiments and documentation planned for future years
- Ex-vessel and in-vessel flooding being considered

OECD NEA – Corium Convection

- CNL will lead an OECD Project investigating corium convection during in-vessel retention (IVR) for a CANDU calandria vessel
- Improve knowledge base regarding corium convection and spatial distribution of heat flux during IVR
- Help establish in-vessel retention

Status and Future Work

- The joint project proposal is currently being discussed with participants

- CANDU utilities (through the CANDU Owners Group) have shown an interest in collaborating on experiments
- Preparation for tests is planned to occur this fiscal year, with tests planned for next fiscal year
- Details of experiments to be determined